FLOCCULATION BIOREACTORS

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An increase in productivity is the main objective in most fermentation processes. This can be accomplished in several ways:

- using high density cell cultures
- improving the separation processes
- using improved (mutated) strains

There are several techniques allowing for the operation with a high biomass concentration. Good productivities were obtained using yeast immobilization and gel inclusion, but mechanical recycling techniques - centrifugation, filtration and ultrafiltration are the only ones that assure good retention of microorganisms. However, their operating costs are high.

Systems using flocculating cultures, which take advantage of cell recycling by natural sedimentation of highly flocculating strains, seem to be a very interesting technique due to its low operation costs and simplicity - no complex mechanical devices are needed.Indeed,construction costs are low and energy inputs are not significant as well.

Also, the utilization of flocculating cells may have an important contribution for the improvement of separation processes in fermentation. Besides being less agressive than other separation techniques, a reduction in production costs is obtained since the amount of cells to be separated by centrifugation or filtration is fairly reduced.

Another very atractive way of improving the overall productivity of fermentation processes is the utilization of genetically improved strains that are simultaneously flocculent. Along with the above refered advantages of flocculating systems, there is another important aspect on this procedure - the selection pressure has no negative effect on the environment since the improved strain may be kept inside the fermentor.

Unfortunately, there is a main disadvantage in flocculation systems. Microbial agregates are characterized by relatively low specific reaction rates. Nutrients have to reach the cells inside the flocs by diffusion into the floc particles. It is known that in cells flocs the overall reaction is mass transfer limited rather than biochemically limited. To take full advantage of flocculating systems mass transfer limitations must be minimized.

The following main aspects of systems using yeast flocculating cultures will be considered:

- the possibility of using an external loop type bioreactor for the induction of flocculation ability in yeast strains
- the characterization of the performance of an external loop type flocculation fermentor, using ethanolic fermentation as a model
- the study of transport mechanisms inside flocs